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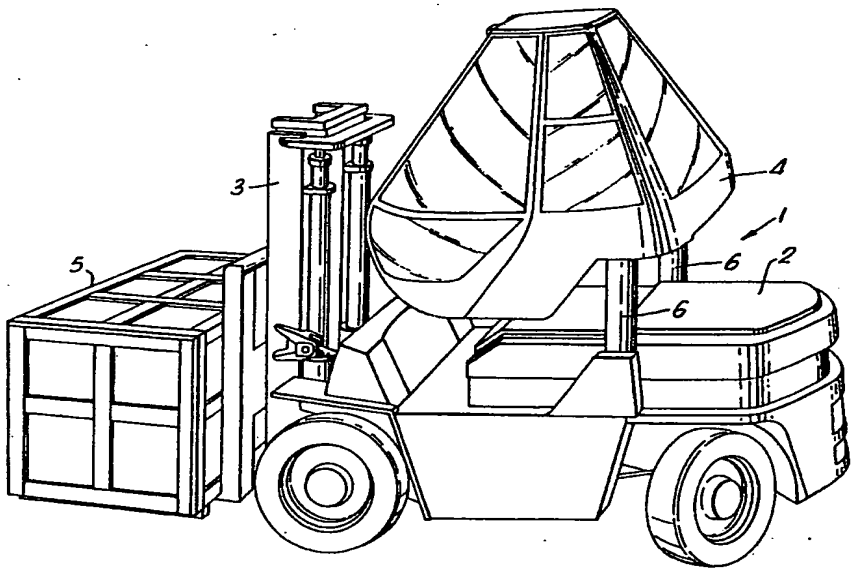

(57) Abstract

A motor-driven fork-lift truck is equipped with a driver's cabin (4) capable of being raised and lowered. The driver's cabin (4) is designed as a separate unit and is mounted on at least one telescopic guide rod (6) which can be adjusted in length by means of a hydraulic cylinder system. Moreover, in order to achieve the best possible isolation of the driver's seat in relation to the fork-lift truck's (1) working section, shock-absorbing devices have been fitted between driver's cabin (4) and frame (2).

* See back of page

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Improvement on a Fork-Lift

The invention relates to an arrangement in connection with a fork-lift truck with a driver's cabin which may be raised and lowered.

When goods or pallet loads have to be moved by means of fork-lift trucks, problems can easily arise due to the fact that the lifting framework of the fork-lift truck with the load lying on the fork will prevent the truck driver from seeing in the direction in which the fork-lift truck is travelling. This problem is particularly prevalent in the case of high loads or where several boxes which are lying on top of each other have to be lifted or loaded.

An attempt has been made to solve this problem by making the driver's cabin of the fork-lift truck capable of rotating, in such a manner that the cabin can be turned and the fork-lift truck driven in the opposite direction, but this leads to other operational problems in connection with turning the fork-lift truck's wheels in relation to the driver's control levers, loss of control of the load, etc.

In the Swedish laid open patent publication No. 446 622 a fork-lift truck is described in which an attempt has been made to counteract the problem of obstacles in the driver's field of vision by mounting the driver's cabin on a framework on diagonal rails on the fork-lift truck, in such a way that the driver's cabin can be moved in a sideways direction and also lifted up on vertical rails. This arrangement, however, is complicated and requires the fork-lift truck to have a relatively wide chassis and a relatively complicated control and lifting mechanism. A solution of this kind will therefore only be applicable on large fork-lift trucks and in practice has not achieved a breakthrough.

Moreover, the driver's seat on fork-lift trucks is considered to be an extremely exposed working place from an environmental

point of view. By reason of their basic construction, fork-lift trucks are not equipped with any kind of springing and in addition the fork-lift truck's wheels have to be pumped up hard due to the carrying capacity. Thus every vibration and jolt will be transferred to the driver's cabin, while at the same time there will be direct contact with the fork-lift truck's motor, so that the driving seat will be extremely exposed to shaking and noise. In addition to this, the fork-lift truck will be mainly used in noisy working areas. It has only been possible to improve these conditions to a limited degree by the use of sprung seats and noise-insulated walls, since the driver will usually have the door open in order to watch what he is doing as he has such a poor view.

The object of the present invention is to provide an arrangement on a fork-lift truck whereby both of the two above-mentioned main problems with to-day's fork-lift trucks are avoided, i.e. whereby the opportunity will be provided for the driver of the fork-lift truck to have a clear view of his working area and driving area and whereby at the same time the driver's working place is given maximum protection against both vibration, bumps and noise.

This object is achieved by a fork-lift truck characterized by the features presented in the claims.

The basic concept of the invention is that the driver's cabin can be modelled as a separate unit, which can be designed in the best possible way both from the sound and environmental points of view, and in which this separate unit can be installed so that it can be raised and lowered in relation to the chassis of the fork-lift truck by means of at least one telescopic guide rod which is operated by means of the hydraulic system which already exists on the fork-lift truck. Such guide rods or the driver's cabin respectively may be positioned at the correct height to obtain the best possible view and be maintained in this position, while at the same time the driver's cabin is completely isolated in relation to

the rest of the fork-lift truck, in that in addition shock-absorbing devices have been fitted between the chassis of the fork-lift truck and the driver's cabin. The driver's cabin unit itself can thereby receive a larger window area giving a better view and be supplied with all modern aids such as, for example, air conditioning, thus providing a working place which is satisfactory, environmentally friendly and protected to the greatest possible degree against noise,jolts and vibration. Shock absorption can be provided preferably by fitting a gas damper in the hydraulic system.

In accordance with the invention the device can easily be installed on the chassis of existing trucks, in that only the said guide rods have to be fitted in the chassis of the fork-lift truck and the electrical and hydraulic contact for control of the fork-lift truck provided, for example through cable loops. The driver's cabin will preferably be fitted on two guide rods, but in the case of smaller constructions a design with only one guide rod may also be considered. It may also be advisable to fit a further cushioning support rod or guide rod in the fork-lift truck's longitudinal direction in order to absorb axial forces. This could be relevant for smaller fork-lift trucks where the guide rods can be hinged on the lower part.

In the following section the invention will be illustrated by means of embodiments which are presented in the accompanying drawings, which show:

Fig. 1 a perspective drawing of a fork-lift truck in accordance with the invention, in a normal position,

fig. 2 a fork-lift truck in accordance with the invention with the driver's cabin raised, and

fig. 3 a diagrammatic sketch of an embodiment for the cylinder rods in an arrangement in accordance with the invention.

The drawing gives a purely schematic illustration of the principles of the arrangement in accordance with the invention. A fork-lift truck, which is identified in toto by reference number 1, has a conventionally designed lower frame or chassis part 2 with inbuilt counterweight to the fork-lift mechanism 3. The fork-lift truck is motor-driven, in that the motor is situated under the driver's cabin 4 and it is driven on four wheels which are all without springing with the back wheels capable of turning. In fig. 1 the fork-lift truck is illustrated in the normal position for lifting of a box 5, and the only feature which here distinguishes the fork-lift truck from the familiar designs is the design of the driver's cabin 4, which is designed as an independent part in relation to the rest of the chassis 2, and which thereby can be given a completely separate design independent of the rest of the chassis. Had there been two boxes 5 stacked on top of each other which were to be lifted by means of the fork-lift truck, the driver would not have been able to see ahead of them. By means of the arrangement in accordance with the invention, however, he would have been able to raise the driver's cabin as illustrated in fig. 2 and thus see over the load 5 even though it is high. Even with one box 5 it will be an advantage for him to raise the driver's cabin, since he will be able to see over the lifting mechanism 3. The driver's cabin 4 is mounted on two guide profiles or guide rods 6 which are connected to the fork-lift truck's chassis 2 in a suitable manner. These guide rods 6 consist of telescopic profile parts, so that the guide rods 6 can be extended and shortened by the driver. It is a simple matter to instal these rods directly on to a normal fork-lift truck chassis. The best place to fit the guide rods is right in front of the steering wheel and projecting partly up into the cabin at the back edge of the driver's seat. The guide profiles in the guide rods slide into each other via an artificial fibre shim which can be made adjustable and which has a sound-deadening effect. The driver's cabin 4 is a self-supported construction.

The lower attachment of the guide rods 6 to the fork-lift truck can be implemented in two alternative ways depending on the size of the fork-lift truck and the required maximum lifting height for the driver's cabin.

In the case of large fork-lift trucks which are intended to run on a good surface, the guide profile can be permanently and rigidly attached to the actual fork-lift truck.

In the case of smaller fork-lift trucks where more severe vibrations can occur, it will be an advantage to hinge the lower part of the guide rod 6 and to fit shock-absorbing attachments higher up, which secure the rods via shock-absorbing devices to the fork-lift truck. The driver's cabin will thereby have spring suspension in the axial direction in addition to the vertical spring suspension which will be described below. The need for such axial suspension will be noticeably greater as the distance increases between the driving surface and the driver's seat.

In fig. 3 there is an illustration, also purely schematic, of the principles for the construction of a guide cylinder 6. Illustrated here is an example of a guide cylinder 6 for a smaller fork-lift truck, i.e. with a sprung support in the axial direction. As already mentioned the guide cylinder consists of two telescopic guide profiles 7 and 8. Inside the rod 6 is fitted a single-acting cylinder 9 which in its longest position can raise the driver's cabin 4 to the highest position. In the illustrated example the guide rod 6 is attached to the frame of the fork-lift truck with a hinge which is described schematically by 10. Above this the guide cylinder 6 is led through the foundation to the driver's cabin as illustrated by 11. In a suitable place on the guide rod a further guide rod 12 is attached, preferably on hinges, which forms a connection with a suitable fixed point on the fork-lift truck's frame or chassis. This can be led via a spring-damping cylinder as schematically illustrated in fig. 3.

The hydraulic cylinder 9 is run from the existing hydraulic unit on the fork-lift truck, as schematically illustrated in 14 on the drawing. Thus, by operation from the driver's cabin, the driver's cabin 4 can be raised and lowered as required until the desired height and field of view for the driver's cabin is achieved. The hydraulic cylinder 9 can then be locked in this position.

In the same way as illustrated in the example in the hydraulic transmission system 15, a spring effect can be achieved by installing a gas damper 16 of a known type, which will provide a spring and shock-absorbing effect for the driver's cabin in relation to the fork-lift truck's frame or chassis 2. The driver's cabin 4 will thereby be sprung and cushioned in relation to the rest of the fork-lift truck, and the driver's cabin as a separate unit, where the only "rigid" connection with the environment is the guide rods 6, constituting a separate unit which can be modelled according to requirements, and air conditioned and shock-absorbed in the best possible manner. The driver's cabin can thereby also be designed in the best possible way with regard to noise insulation. All control connections between the driver's cabin and the fork-lift truck will be made via a not shown electric cable or hydraulic hoses which it would be advantageous to have collected together and form a large arc in a rearward direction and follow the driver's cabin in its various positions.

In the position illustrated in fig. 1, the driver's cabin will preferably still be situated a short distance above the chassis 2, i.e. without physical contact and retaining the effect of the damping bodies as well as the gas damper 16. The gas damper will be capable of adjustment with regard to volume and pressure, so that the driver's cabin 4 receives the required springing effect. It will also be possible to introduce shock-absorbing effects in order to avoid unnecessary "tilting" or "pitching". On the chassis or the underside of the fork-lift truck it would also be an advantage to fit additional soft rubber elements in order to provide cushioning if for some

reason the driver's cabin has to be lowered 100% down on to the chassis or frame 2.

It should be obvious that many modifications will be possible within the framework of the invention, and that the design of both the hydraulic system, control systems, suspension systems, etc. will be capable of modification by means of more or less well-known techniques. In the illustrated example the driver's cabin 4 has also been fitted with two parallel guide rods 6 fitted across the longitudinal direction of the fork-lift truck, but this should not be a limiting factor, in that a design with, e.g., only one guide rod may be conceivable for special purposes or for small fork-lift truck designs, while in the case of large fork-lift trucks some may require more than two guide rods in order to avoid tilting. All such modifications are intended to fall within the scope of the invention.

PATENT CLAIMS

1. A driver's cabin for a fork-lift truck, characterized in that the driver's cabin (1) is equipped with one or more guide rods (6), which are attached to the fork-lift truck's frame (2), the guide rods are designed as known per se for hydraulically-operated telescopic cylinder arrangements,
that in the hydraulic system which is connected to the fork-lift truck's hydraulics, a gas damper (16) is fitted, and in order to achieve permanent springing by means of gas dampers during the operation of the fork-lift truck in the lowest position for the driver's cabin (1), the driver's cabin still has a clearance in relation to the frame (2).

2. A driver's cabin in accordance with claim 1, characterized in that the guide rods (6) are joint-mounted on the fork-lift truck's frame (2) and equipped with an axial, springing, additional attachment higher up on the guide rod (6).

3. A driver's cabin in accordance with claim 1, characterized in that the guide rod is permanently attached to the vehicle frame.

4. A driver's cabin in accordance with claim 1, characterized in that the guide rods (6) are equipped with sound-deadening guides.

5. A driver's cabin in accordance with claim 1, characterized in that there are arranged in the guide rods (6) single-acting cylinders (9), which are controlled from the driver's cabin (4).

6. A driver's cabin in accordance with claim 1 wherein in addition there are arranged soft rubber shock-absorbing elements for additional damping of the driver's cabin (4) in

relation to the frame (2) for the absorption of extreme shocks when the driver's cabin is in the fully lowered position.

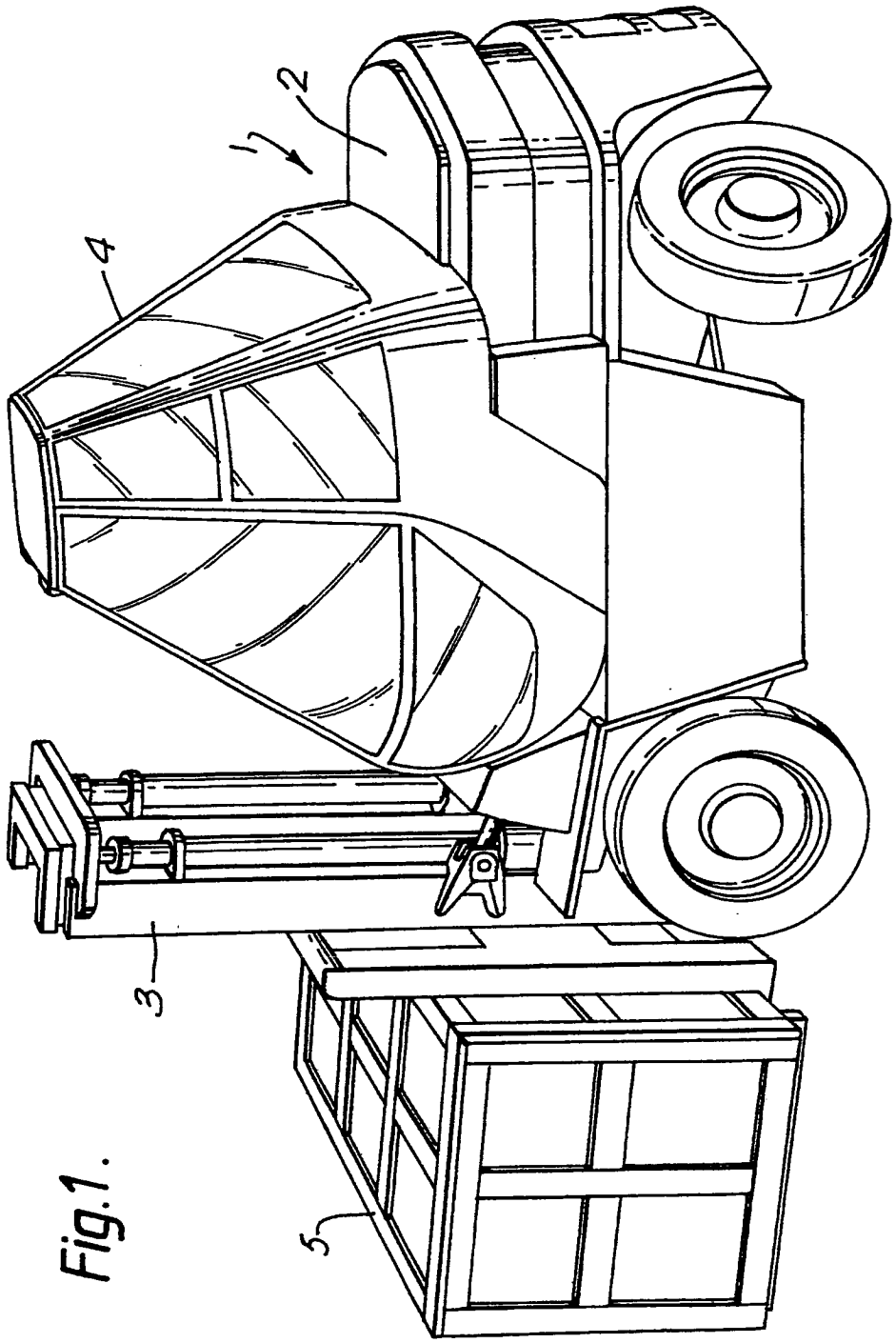


Fig.1.

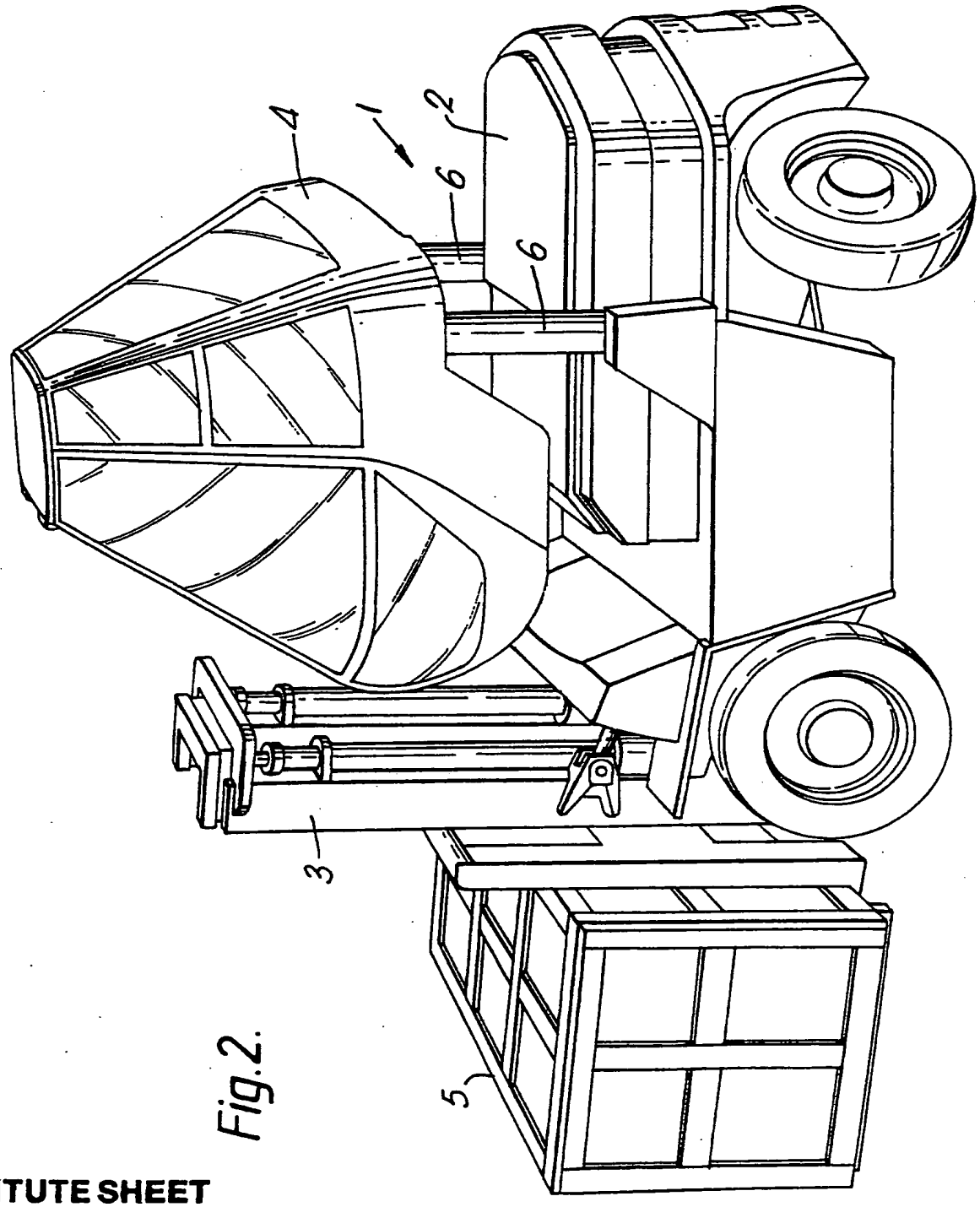
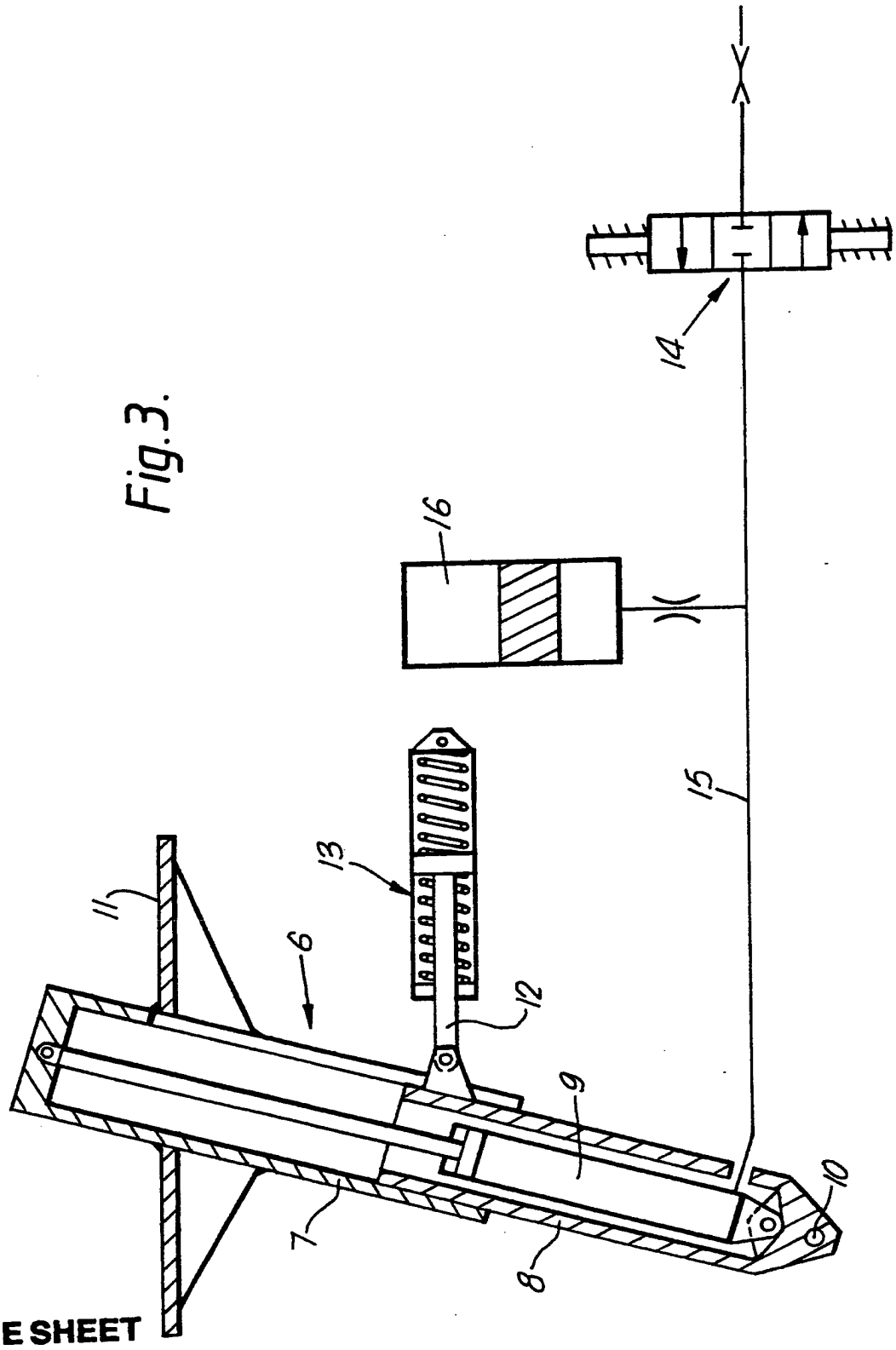


Fig.2.

Fig.3.



INTERNATIONAL SEARCH REPORT

International Application No PCT/NO 90/00146

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 66 F 9/075

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 66 F; B 62 D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	SE, B, 461089 (SVEN NYLIN & MÄRTEN JOHANSSON) 12 March 1989, see the whole document --	1
A	SE, B, 446622 (KALMAR LAST MASKIN VERKSTAD AB) 4 June 1986, see the whole document --	1
A	NY TEKNIK, TEKNISK TIDSKRIFT, Vol. 48, November 1984 (Stockholm) B.O. Gustavsson: ""Smålänningar bygger världens största gaffeltruck åt Khadaffi"", see page 29 --	1
A	DK, B, 155640 (ERIK DOLLING) 1 May 1989, see the whole document --	1

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
20th December 1990	1990 -12- 28
International Searching Authority	Signature of Authorized Officer
SWEDISH PATENT OFFICE	Ulrika Drangel

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. PCT/NO 90/00146

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 90-11-28
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE-B- 461089	89-03-12	SE-A- 8703534	89-03-12
SE-B- 446622	86-06-04	DE-A- 3560881	87-12-10
		EP-A-B- 0185928	86-07-02
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		US-A- 4630700	86-12-23
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